

# Contents

## Part A. Theoretical Issues

<i>Chapter I.</i> Visual Information and Valid Reasoning . . . . .	3
JON BARWISE and JOHN ETCEMENDY	
1 Introduction . . . . .	3
2 The Legitimacy of Heterogeneous Inference . . . . .	4
3 Hyperproof . . . . .	14
4 Inference as Information Extraction . . . . .	21
5 Conclusions . . . . .	23
<i>Chapter II.</i> Operational Constraints in Diagrammatic Reasoning . .	27
ATSUSHI SHIMOJIMA	
1 Introduction . . . . .	27
2 Free Rides . . . . .	29
3 Overdetermined Alternatives . . . . .	33
4 A Formal Model . . . . .	37
5 Conclusions . . . . .	47
<i>Chapter III.</i> Diagrams and the Concept of Logical System . . . . .	49
JON BARWISE and ERIC HAMMER	
1 The Standard Story . . . . .	50
2 Examples of Diagrammatic Logics . . . . .	55
3 Examples of Heterogeneous Logics . . . . .	64
4 Classifications of Diagrammatic Systems . . . . .	69
5 Conclusion . . . . .	77

## Part B. Case Studies

<i>Chapter IV.</i> Situation-Theoretic Account of Valid Reasoning with Venn Diagrams . . . . .	81
SUN-JOO SHIN	
1 Syntax . . . . .	82

2	Semantics . . . . .	93
3	Rules of Transformation . . . . .	98
4	Soundness . . . . .	104
5	Completeness . . . . .	105
<i>Chapter V. Towards a Model Theory of Venn Diagrams . . . . .</i>		109
ERIC HAMMER and NORMAN DANNER		
1	Syntax . . . . .	110
2	Semantics . . . . .	115
3	Rules of Inference . . . . .	117
4	Soundness and Completeness . . . . .	119
<i>Chapter VI. Peircean Graphs for Propositional Logic . . . . .</i>		129
ERIC HAMMER		
1	Graphical Syntax . . . . .	131
2	The Interpretation of Peircean Graphs . . . . .	135
3	Rules of Inference . . . . .	137
4	Soundness . . . . .	141
5	Completeness . . . . .	143
<i>Chapter VII. A Diagrammatic Subsystem of Hilbert's Geometry . . . . .</i>		149
ISABEL LUENGO		
1	Introduction . . . . .	149
2	Syntax . . . . .	151
3	Semantics . . . . .	156
4	Rules of Transformation . . . . .	163
5	Proofs . . . . .	166
6	Soundness . . . . .	169
7	Completeness . . . . .	172
<b>Part C. Heterogeneous Systems</b>		
<i>Chapter VIII. Heterogeneous Logic . . . . .</i>		179
JON BARWISE and JOHN ETCHEMENDY		
1	Historical Background . . . . .	179
2	Logic and Information . . . . .	180
3	Homomorphic Representations . . . . .	181
4	Hyperproof . . . . .	186
5	Towards a Mathematical Analysis of <i>Hyperproof</i> . . . . .	190
6	Conclusions . . . . .	199
<i>Chapter IX. Toward the Rigorous Use of Diagrams in Reasoning about Hardware . . . . .</i>		201

STEVEN D. JOHNSON, JON BARWISE, and GERARD  
ALLWEIN

1	Introduction . . . . .	201
2	The Circuitproof Project . . . . .	202
3	Diagrams and Hardware Description . . . . .	203
4	The Single-Pulser Example . . . . .	206
5	A Mathematical Basis . . . . .	210
6	Conclusions . . . . .	221
7	Acknowledgments . . . . .	223

<i>Chapter X.</i>	Exploiting the Potential of Diagrams in Guiding Hard- ware Reasoning . . . . .	225
-------------------	---	-----

KATHI D. FISLER

1	Introduction . . . . .	225
2	Contrasting Diagrammatic and Sentential Representations . . . . .	227
3	Heterogeneous Hardware Logic . . . . .	231
4	The Island Traffic Light Controller . . . . .	245
5	Conclusions . . . . .	255
6	Acknowledgements . . . . .	256

Bibliography . . . . .	257
------------------------	-----

Index . . . . .	267
-----------------	-----